REMARKS

The above-noted application has been carefully reviewed in light of the first Office Action dated February 2, 2009 an the citations applied by the Examiner in formulating a rejection of all of the claims under the provision of 35 U.S.C.103(a).

Applicant has herein revised all of the claims and for the sake of simplicity has cancelled many of the same and rewritten them in their entirety.

The original claims suffered to a degree from an inaccurate translation from the original German text.

It is now believed that this problem has been overcome and that the claims, as now presented, are clear more accurately define the invention and distinguish over the cited prior art.

The claims have been rejected as unpatentable over the patent of *Shibata et al.* Pat. No. 6,466,831 taken in view of the teaching of *Kopelman et al.* Pat. No. 6,664,986. Applicant respectfully traverses this rejection as more clearly set forth below.

The invention claimed herein relates to a method for displaying a digitized dental technical object, such as a dental prosthesis, a model of at least a single tooth, or an area of the jaw that is to be provided with the dental prosthesis. The display appears on a monitor on the basis of

a right-angled coordinate system with X, Y, and Z axes. The Z-axis and the Y-axis and the intersection (origin of the coordinate system) run in the image plane of the monitor and the X-axis runs perpendicular to the image plane. The dental technical object is rotated about two axes running perpendicular to each other and is shifted along the X-axis for zooming the object.

This method may be used such that an intuitive and simple adjustment of virtual models of dental objects, and in particular, teeth or rows of teeth, are made possible within the framework of visualizing scanned data as well as CAD models of artificial dentures. Further, due to the digitized data of the area of the jaw to be provided with the dental object, one or more tooth stems and artificial dentures are visually shown on the monitor which assists in the manufacture of these dental objects based on the data.

In order to solve the existing problems, the dental technical object is aligned along a T-axis running in a plane defined by the X-axis and the Y-axis and passing through the origin of the coordinate and is moved to a maximum of five degrees of freedom, whereby a rotation (Rot_z) about the Z-axis is chosen as the first degree of freedom, a rotation (Rot_t) about the T-axis is chosen as the second degree of freedom, a translation of the object along the T-axis is chosen as the third degree of freedom and the translation of the object along the X-axis is chosen as the fourth degree of freedom.

In contrast to technical 3D-CAD systems, with whose assistance objects can be displayed and manipulated, requiring object movement around all six degrees of freedom, a

simplified reduction occurs according to the present invention using 4 or 5 degrees of freedom. In the instant case, it is sufficient to consider the virtual dental crowns and the are of the jaw to which they are to be used. Surrounding areas, such as jaw bones, lips, and the tongue are not of importance for technical dental restorations, and are not therefor digitized. Further, the tooth root which is covered by the gums and the inside of the tooth are not taken into account with computer-assisted tooth restoration.

In summary, the invention provides a method for adjusting a monitor displayed digitized section of, for example, a row of teeth, in a coordinate system using a input device, whereby the object is aligned around a maximum of five, but preferably four degrees of freedom.

The following are attributes of the method:

1. Rotation about the Z-axis through the coordinate origin.

2. Rotation around the longitudinal axis of the object (T-axis), which runs along the row of teeth through the coordinate origin, whereby the rotation is preferably reduced, thus effecting a tilt.

3. Translation of the object along the longitudinal axis of the object (T-axis) and in as much as is limited, since the coordinate origin always lies inside the object, and

4. Translation along the X-axis from the coordinate origin to the viewer (zoom).

A careful reading of the *Shibata* and *Kopelman* shows no suggestion of the claimed teaching of this application herein.

Actually, the closest of these two patent would appear to be *Kopelman* since the invention in the present application relates to a method for displaying on a monitor a dental technical object.

Shibata is not concerned with a method for displaying an object on a monitor but rather to a three-dimensional data input device. According to this disclosure (column 6, line 36 through column 7, line 25), three-dimensional data input is provided such that use of a mouse 3 permits the movement of an object to be displayed on a monitor to a total of six degrees of freedom. The data input device or mouse is so designed such that there is a possibility to move an object translatory along the X, Y, and Z axes (column 7, lines 4-12). Zooming is performed when moving along the Y axis.

Additionally, it is possible to rotate an object to be displayed on a monitor around the X, Y, and Z axes (column 6, lines 48, 59, and column 7, line2).

Shibata is typical of the state of the art previously used in connection with 3D-CAD systems. It certainly does not teach any relationship with dental technology and it is also silent with regard to the restriction of the display of the object such that the same can be moved to a <u>maximum</u> of five degrees of freedom as provided by this invention.

New claim 24 replaces original claim 1 and defines the degrees of freedom clearly, namely, a rotation about the Z-axis, a translation along the X-axis, and a translation and rotation about an additional axis (T-axis) running in the X/Y plane and beginning at the origin of the coordinate system.

Insofar, it is mandatory that the dental technical article to be displayed is aligned along the T-axis. This is not disclosed by *Shibata*. Movement to only five degrees of freedom is not possible in *Shibata*, nor is an additional axis provided, relative to which the object to be displayed is aligned, (the additional axis must pass through the object to be displayed. *Shibata* allows aligning the object relative to each axis, i.e. it is not mandatory for the object to be passed through by an axis.

In our disclosure, rotation about the X-axis provides the 5^{th} degree of freedom and said X-axis corresponds to the Y-axis in *Shibata*.

The present method and that taught by *Shibata* are totally different with respect to displaying an object on a monitor. There is no teaching or suggestion of displaying a dental technical object. Display of such an article is shown by *Kopelman*. The dental technical object is shown in desired positions. For this purpose, stepwise rotation of the section of a jaw, for example, around the Y-and Z-axes lying in the plane of the monitor is possible. Zooming the object along the X-axis is possible. However, restriction of the movement relative to the number of degrees of freedom does not result. In addition, no hint can be found in this patent to align the dental technical object along the axis running in a plane defined by both X- and Y- axes. Consequently, the further features set forth in Claim 24, namely, rotation and movement about and along, respectively, the T-axis cannot be anticipated pf suggested by *Kopelman*.

With regard to the dependent claims;

Claim 2 suggests moving the dental technical object to a maximum of four degrees of freedom as opposed to *Shibata* which provides strictly the possibility of movement around six degrees of freedom, the same being excluded by our claim 2.

Claim 3 provides rotation around the X-axis for a fifth degree of freedom, Each of the cited references disclose rotation of an object about an X-axis, but since this claim depends from claim 24, it includes all of the limitations therein and the references cannot be considered as anticipatory.

Claim 4 provides restriction of the movement of the dental technical object about the T-axis. The provision of such an additional axis cannot be found in the prior art of record. Additionally, the art is silent regarding restriction of rotation.

The recitations in Claim 5 insure that the technician who is to align intuitively and simply a virtual model of a dental technical object , records the object optically. For this purpose, the invention provides that the dental technical object is displayed on the monitor in such a way that the dental technical object, independent of its movement or presentation, is passed through by the origin of the coordinate system. *Shibata* is silent and lacks any suggestion of this feature and in fact, as shown in Figure 3A, shows that the origin point is decentralized.

Dependent Claim 6 provides that the longitudinal axis of the dental technical object is formed by a traverse polygon with straight lines connecting the sections of the dental technical object, so that shifting the dental technical object along the T-axis, shifts the same along a straight line of the traverse polygon which passes through the origin of the coordinate system. Thereby, during movement through the sections of the traverse polygon, the object is rotated from section to section about the angle β, so that the sections when viewed correspond as to their direction.

Claim 7 has been replaced by new claim 25 which depends from claim 6.

Claim 8 includes a reduced translation of the object along the T-axis. This axis is not known in the prior art of record as previously noted. Neither *Shibata* nor *Kopelman* provide a restriction of the translation along the X-, Y- or Z-axes.

Claims 9 and 10 differ from the cited art and provide that the origin of the coordinate system is independent of the movement of the object and is placed approximately in the center of the monitor display.

The dependent claims that relate to details of the input device (trackball for example) recite structures that are similar to *Shibata*, however since they depend from claim 24, they are not anticipated.

Claims 12, 13 and 14 have been replaced by new claims 26. 27 and 28 and claims 16, 17 and 18, by new claims 29, 30, and 31.

Claim 19 is the second independent claim in this application and the remarks noted above regarding the prior art are applicable here. Further, no suggestion can be found in *Kopelman* that an actual dental prosthesis is manufactured on the basis of the dental object that is digitized and displayed on the monitor., and, if necessary, after its modification.

Claim 23 has been replaced by new claim 33 which depends from claim 19. The dental prosthesis and/or the jaw area are moved but shifting cannot exceed four degrees of freedom. Each of the cited references allow shifting of six degrees of freedom.

The patent to *Wang*, Publication No. 2002/0060663 has been referenced in the Section 103 rejection of claims 15-17. This reference teaches a computer input device for multiple dimensional control. Its combination with *Shibata* and *Kopelman* is not believed to anticipate the presently claimed invention.

Claim 21 has been cancelled and replaced by new claim 32. this claim along with claim 22 depend from parent claim 19 and provide for moving the dental prosthesis on the monitor to a maximum of five degrees of freedom.. These claims teach that the data for the dental prosthesis displayed on the monitor is used for manufacturing an actual prosthesis.

Claim 32 (replacing original claim 21) includes the use of a data library (stored parameters) for ensuring that the artificial teeth fall within necessary dimensions.

Claim 22 mentions modification of the prosthesis that appears on the monitor display. The Examiner has cited the published application of *Rubbert et al.* Pub. No. 2002/0010568 in the rejection of this claim. This patent is represented in the Office Action as teaching assessment of artificial dentures based on the digitized data of the jaw area to be provided with the dentures with stored parameters, and characterized in that the artificial dentures which are shown on the monitor are modeled by an electronic change of the data, obtaining the three-dimensional digital data of the patient's teeth from the scanning node and displaying the model.

Rubbert et al. has been combined with the *Shibata* and *Kopelman* teachings in the formulation of this rejection .

This last reference relates to a CAD method for producing dental prostheses and is known state of the art technique. It is not however known to retrieve data from a stored library relating to wall thickness of the artificial teeth and/or to the cement gap between such dentures and jaw area; said data being used for the production of artificial teeth.

In summary, the state of the art s exemplified in the references of records fails to provide any suggestion of displaying a digitized dental technical object on a monitor and modification of that image. Simplification is achieved by restricting the number of degrees of freedom and an additional

axis (T) is added to the X-, Y-, and Z- axes of the Cartesian coordinate system, with the dental technical object being aligned to the T-axis.

In light of the amendments made herein and the comments noted above, reconsideration of the rejection of the claims is solicited.

Respectfully submitted,

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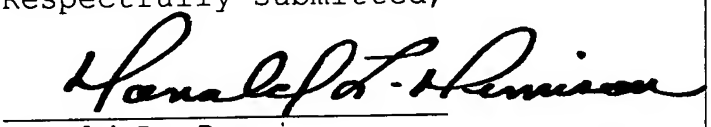

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